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March 28, 2007

Via Hand Delivery

Jean Jewell, Secretary
Idaho Public Utilities Commission
472 W. Washington St.
Boise, Idaho 83720

Re: Case No. UWI-W-06-05

Dear Ms. Jewell:

Enclosed for filing in the above matter please find the original and seven (7) copies of United Water Idaho Inc's Reply Comments.

An additional copy of the document and this letter is included for return to me with your file stamp thereon.

Very Truly Yours,
McDevitt & Miller LLP

Dean J. Miller

DJM/hh
Attach.

ORIGINAL

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BEFORE THE IDAHO PUBLIC UTILITIES COMMISSION

IN THE MATTER OF THE APPLICATION OF UNITED WATER IDAHO INC., FOR APPROVAL OF ITS WATER CONSERVATION PLAN AND FOR APPROVAL OF A WATER CONSERVATION SURCHARGE AND REQUEST FOR MODIFIED PROCEDURE	**CASE NO. UWI-W-06-05** **REPLY COMMENTS**

COMES NOW United Water Idaho Inc., ("United Water", the "Company") and makes the following Reply Comments in response to the Comments of Commission Staff dated February 23, 2007.

Introduction

Pursuant to Commission Order Nos. 29871 and 29934, United Water, on December 1 2006, filed with the Commission an Application for approval of an updated Water Conservation Plan that accompanied the Application.

As part of the Application, United Water also filed Direct Prefiled Testimony of Gregory P. Wyatt, United Water's General Manager. In his testimony Mr. Wyatt explained the steps the company took to develop the new Plan. United Water sent requests for proposals to eight (8) qualified consultants with experience in developing water utility conservation plans. In April of

2006 a contract was awarded to Maddaus Water Management to assist in developing the new Plan at a cost not to exceed $80,000. (Wyatt, Direct, Pg. 1).

Thereafter, a rigorous process, involving interested stakeholders and including the Staff of the Commission, analyzed potential conservation measures. Ultimately, seven (7) measures were found to be cost effective and form the basis of the new Plan. When implemented, the annual cost of the new measures will be approximately $124,200 over current conservation related expenditures. (Wyatt, Direct, Pg. 2—3). This will bring the total annual conservation expense to approximately $244,200, taking into account conservation efforts already being implemented.

Mr. Wyatt's testimony also discussed potential cost recovery methods for the increased level of conservation expenditures. (Wyatt, Direct, Pg. 3—5).

The Staff Comments, filed in response to the Application, conclude with five (5) recommendations. They are:

1. The Company should continue the existing conservation efforts and implement the measures proposed in the Plan. The Company should work with Staff to further refine the details of program design and implementation and in the development of procedures to better evaluate results.

2. The Company should re-evaluate the more objective program measures using the full supply side avoided costs to establish the value of savings.

3. The Company should use informational programs in support of objective programs. Where appropriate, implement focused pilot programs to refine program operational details and demonstrate the savings of objective measures.

4. The Company should pursue water saving code improvements, developer agreements and hook-up requirements to conserve water.

5. The Commission should reject the proposed conservation tariff rider, and instead authorize deferred accounting treatment of the additional costs for later demonstration of reasonableness.

In these Reply Comments, United Water will discuss each recommendation in sequence.

Implement Proposed Measures and Work with Staff to Refine Details

Subject to conditions discussed below, United Water concurs in this recommendation to implement the programs, but, based on experience in the Plan preparation process, United Water respectfully suggests that the role of Staff during the implementation phase be clearly defined.

As stated in Staff Comments, a representative of the Commission Staff was invited and participated in the initial screening meeting of the planning process which ultimately resulted in the current Conservation Plan. (Staff Comments Pg. 6). Although the Staff representative actively participated in the initial screening meeting, and frequently took the lead in determining a particular conservation measure's ranking, he did not participate in any of the subsequent screening and evaluative meetings. The Staff representative was copied on results of all meetings and was asked to provide input and feedback as the team further evaluated the potential measures. However, the Staff representative did not provide any input or feedback throughout the remaining planning process following the initial screening meeting.[1]

Staff's suggestion for further refinement of implementation details appears to be based on a criticism that with respect to six of the seven measures the Plan does not contain implementation details. (Staff Comments, Pgs. 3—6). The Plan identifies in general what each measure involves, and suggests options as to how the Company could implement each one. This provides the Company with ideas, options, and the flexibility to choose an appropriate implementation approach for each measure. The Company fully intends to develop a more targeted approach for implementation of each measure, but to do so before receiving Commission approval of the Plan and the measures is both premature and risks wasting Company resources on developing detailed implementation plans on measures it yet has no assurance will be approved.

[1] Information in this paragraph is provided by Gregory P. Wyatt.

With respect to the role of Staff during the implementation phase, United Water suggests that active participation by Staff in the development of the implementation procedures is not required. Rather, at least initially, the development of implementation procedures should be the responsibility and the prerogative of the Company. United Water would provide periodic updates to Staff as the procedures are developed so that Staff may monitor progress toward program implementation. This approach would allow for prompt implementation while preserving the Commission's oversight responsibilities.

The recommendation to develop procedures to better evaluate results appears to be based on a criticism that the Plan as submitted does not contain adequate evaluation measures. (Staff Comments, Pgs. 3—6).

In principle, United Water agrees that evaluation can be a sensible component of any Plan, but notes that evaluation of water conservation measures is not yet a precise science. Staff appears to concur:

> "Estimating savings from a conservation program is a difficult and imprecise process *under the best of conditions*, but especially so for educational and public information programs. It is difficult to determine the number of real customers exposed to the information, the number of customers that actually implement a particular conservation measure, and the amounts of water actually saved..." (Emphasis added). (Staff Comments, Pg.7).

Staff also acknowledges that the cost of evaluation can exceed the actual benefit obtained from specific measures:

> "The most reliable estimates of educational programs are based on surveys of customers who receive promotional materials and a control group to estimate the percentage of participants that actually take the actions being promoted. *Significant concerns about these estimates include the accuracy of the survey responses, and the persistence of the savings from measures that rely upon customer actions rather than hardware. In most cases, the cost of such an evaluation significantly exceeds the amount spent for the program...*" (Emphasis added). (Staff Comments, Pg.7).

In light of these admitted deficiencies in customer surveys, United Water does not agree with Staff's suggestion that the Company be required to conduct surveys of participants in all of its programs. (Staff Comments Pg. 10). The Company contends that because the estimated annual program cost of $124,200 for all measures is relatively low (unlike the cost of a new well which can cost between $400,000 and $700,000), it would be imprudent for the Company to undertake expensive customer surveys as proposed by Staff when, as Staff acknowledges, the cost of such evaluations in most cases significantly exceed the amount spent for the program.

Re-Evaluate Measures Using Full Supply Side Avoided Cost[2]

This recommendation appears to be based on a criticism that the screening process was subjective and eliminated options that should have been more fully considered. (Staff Comments Pg. 6).

As discussed above, the original list of 91 measures included a variety of measures including objective measures. The measures selected for further evaluation were based on the screening process described in the 2006 publication of the American Water Works Association: Water Conservation Programs - A Planning Manual M52 on page 56-59. (Copies are attached as Exhibit A).[3] The manual outlines the criteria and scoring process that was used in the United Water Idaho Conservation Report to eliminate measures that are not appropriate for the service area. The panel reviewing the measures was a diverse group of individuals from the Boise area including a staff member from the Public Utilities Commission. In addition to being in the

[2] Information in this section of these Reply Comments was provided by William Maddaus, the Company's retained consultant and author of the Conservation Plan.

[3] The American Water Works Association (AWWA) is an international nonprofit scientific and educational society dedicated to the improvement of water quality and supply. AWWA is the largest association of water professionals in the world. *See* www.awwa.org

AWWA M52 manual, this method and approach has been peer reviewed and accepted by many water industry professionals.

The Staff Comments also question whether the cut-off point for further evaluation was reasonable. (Staff Comments, Pg. 6—7) This cutoff point is also listed in the AWWA M52 Manual on page 59, and has been used in many similar studies for 12 years including San Francisco, Atlanta, Houston, and Denver. These areas all had diverse water supply conditions, climate, water use patterns, and found this methodology and cutoff of 17 provided a representative and appropriate list of measures. In the Consultants' experience, this process eliminated measures (measures that scored lower than 17) that would prove to not save significant amounts of water, have a low customer implementation rate, and/or not be cost effective.

Benefit cost analysis has been used by the Consultant and other professionals to evaluate water conservation projects for more than 30 years. The evaluation process is well established and based on sound economic principles and experience. This method, including how the marginal cost of water saved is calculated, is outlined in the AWWA M52 manual on page 73-80.

In direct reference to the Water Conservation Potential Assessment prepared by the water utility of the City of Seattle dated May 2006, the comparison of conservation measures is based on "Utility Average Annual Cost" and "Marginal Cost per CCF "(of water saved). Benefit cost ratios are not the same as marginal cost ratios and cannot be directly compared (marginal cost ratios are not typically used in the water industry). The Seattle report did not include a benefit cost analysis or benefit cost ratios.

The benefit cost analysis used by the Consultant evaluated the benefits that could be realized from implementing water conservation programs. The avoided costs considered are described in the United Water Conservation Plan on page 53 and match the list of potential benefits to be considered as shown in AWWA M52 Manual page 70 including:

- Reduced water purchases from wholesale water agencies (not applicable – United Water has its own sources and does not purchase water)
- Reduced variable operation and maintenance cost (energy from pumping, production and treatment and distribution and lower chemical use) estimated at $103.80 per million gallons for United Water.
- Reduced or deferred capital expansion project costs, including new wells and water treatment and aquifer storage and recovery, etc.
- Reduced water storage cost (not applicable - water stored in aquifers)
- Reduced wastewater processing cost (not applicable - different agency processes wastewater)

It is not appropriate to evaluate the benefits based upon the "full cost of water production facilities". In United Water's service area, many of the water facilities that will be used to supply the water in the future could not be reduced or deferred based on future water savings because they already exist and represent a sunk cost. The existing facilities could operate at less than full capacity, but they remain a fixed cost and therefore are not a potential benefit to the program.

The only facilities that can be downsized or deferred are the 19 projects listed on page 53 of the Company Conservation Plan and considered in the Consultant analysis. The savings can only be generated from avoiding or deferring building future projects. The projects used in the

Plan are from the United Water's Capital Improvement Plan to meet the future demands. The mix of projects is based on supply availability and anticipated future growth patterns. It is important to base conservation benefits on the actual mix of planned projects instead of the most expensive supply option(s). The future water savings will be spread across the entire service area because the programs cover the entire service area and will not be targeted to those parts of the Company's service area that the most expensive supply option(s) are Planned to serve.

For these reasons, United Water does not believe re-evaluation of program measures is warranted.

Use Informational Programs and Focused Pilot Programs

This recommendation appears consistent with the approach suggested by the Plan, and United Water therefore concurs. The Plan provides:

> "It is recommended that as each new program is rolled out that part of the program design be devoted to assessing how well the program is working. For programs where there is uncertainty about how well the program will work, pilot programs are normally run to assess the success rate of the program." (Plan, Pg. 83).

The Company intends to develop "pilot programs" where appropriate as it implements the proposed Plan if it is approved by the Commission.

Pursue Code Improvements, Agreements and Hook-Up Requirements

Staff Comments acknowledge that these recommendations pertain to areas over which United Water does not have legal authority and United Water cannot mandate implementation of any of the suggested conservation improvements.

United Water has, and will, support sensible conservation efforts when proposed by others.[4]

[4] As discussed below, United Water's performance in this area should not be a criteria for determining whether deferred conservation expenses may be amortized.

Reject Conservation Rider, Authorized Deferred Accounting Treatment

As explained by Mr. Wyatt in his Direct Testimony the Company's position on this issue is:

> "Should the Commission determine that a water conservation surcharge is not advisable, and that recovery should be through the historical inclusion in base rates approach, The Company would suggest that it be allowed to accumulate the costs for implementing the new Plan measures in a deferred account. Since the Plan recommends implementing the measures in a phased approach, it would likely take two to three years before the costs reach a stable annual level. The Company believes that a deferral of these "start-up" costs and subsequent allowance of a reasonable amortization period, in conjunction with inclusion of annual Plan costs in base rates, is an appropriate means to protect customers while not requiring the Company to subsidize the Conservation Plan implementation between general rate cases." (Wyatt, Direct, Pg. 5).

United Water, however, is concerned with the open-ended nature of the recommendation that the costs be deferred for "later demonstration of reasonableness." (Staff Comments, Pg. 14). Understandably, United Water does not desire to find itself in its next case having to litigate whether its implementation efforts were sufficient under a vague standard of "reasonableness." United Water would appreciate clarification in the Commission's Final Order of the proof that will be required to permit amortization of deferred costs. United Water suggests order language along the following lines:

> "In the ordinary course of events, in a subsequent rate case United Water may expect to receive approval for amortization of deferred conservation expense upon a demonstration that:
>
> a). The program measures identified in the Plan were implemented consistent with the Plan and,
>
> b). The expenses of implementation were recorded on the Company's books so as to permit audit and verification."

Conclusion

United Water looks forward to implementation of the 2006 Water Conservation Plan and the realization of the accompanying benefits to customers. United Water respectfully suggests that the Commission enter its order approving the Plan, consistent with the clarifications and suggestions contained in these Reply Comments.

DATED this 28 day of March, 2007

UNITED WATER IDAHO INC.

By: _____
Dean J. Miller
Attorney for United Water Idaho Inc.

CERTIFICATE OF SERVICE

I hereby certify that on the 28th day of March, 2007, I caused to be served, via the method(s) indicated below, true and correct copies of the foregoing document, upon:

Jean Jewell, Secretary Idaho Public Utilities Commission 472 West Washington Street P.O. Box 83720 Boise, ID 83720-0074 jjewell@puc.state.id.us	Hand Delivered U.S. Mail Fax Fed. Express Email	X ☐ ☐ ☐ ☐
Weldon B. Stutzman Idaho Public Utilities Commission 472 West Washington Street P.O. Box 83720 Boise, ID 83720-0074	Hand Delivered U.S. Mail Fax Fed. Express Email	X ☐ ☐ ☐ ☐
Kevin L. Lewis Conservation Director Idaho Rivers United P.O. Box 633 Boise, ID 83701 Kevin@idahorivers.org	Hand Delivered U.S. Mail Fax Fed. Express Email	☐ X ☐ ☐ ☐

Heather Hude, Legal Asst.
McDEVITT & MILLER LLP

PREPARE LIST OF POTENTIAL CONSERVATION MEASURES

As part of the evaluation of appropriate measures, a list of potential measures that may be appropriate for the area should be compiled. This process generally yields over 100 potential conservation measures in the typical customer categories of

- Residential
- Commercial
- Industrial
- Public
- Irrigation

Sources of information on conservation measures include the *Handbook of Water Use and Conservation: Homes, Landscapes, Businesses, Industries, Farms*[8]. California Urban Water Conservation Council's Memorandum of Understanding that contains a list of Best Management Practices[9] (see chapter 2), the Arizona Department of Water Resources list of Reasonable Conservation Measures[10], and various other states that have conservation guidelines.

SCREENING OF CONSERVATION MEASURES

The first step in any screening is the development of a menu of measures. A typical list of potential measures is provided in the matrix shown in Table 3-6. This table should include all measures being considered. Many of the measures overlap in water savings, i.e., they target the same areas for water conservation. This potential overlap can be accounted for, where necessary, during the combination of measures into alternative programs.

Screening Process

The following terms are used in the screening process:

Device. A physical item of hardware, such as a new toilet, or specific action by individuals, such as commercial audits, that would save water if the recommendations are implemented or carried out by the water utility or some other group.

Measure. A device(s) plus a distribution method and possibly an incentive, such as a rebate, targeted at a particular type of end user that, when implemented, will save water.

Program. A set of one or more measures targeted at one or more customer classes that would be managed by the Water Utility as a separate project.

Plan. A set of one or more programs together with an estimated budget, schedule, and staffing plan.

Screening Criteria

Cost-effectiveness. In some states or regions, a list of which measures are considered cost-effective for most utilities may already be compiled. For the purposes of a first screen of measures, only those that are more than ten times the cost of a utility's alternative next source of supply should be eliminated. As a general guide, the measures other utilities believe are cost-effective should be used, or the list in Table 3-6 can be used. Chapter 4 covers evaluation of detailed costs and benefits. If information is available on what the next least costly source of alternative water supply is for the utility, this should be used to avoid spending a lot of time on measures ten times or more costly.

Table 3-6 Example of potential conservation measures

Device or Program	Measure: Distribution Method & Incentive	Measure: Description
	Single Family Residential—Existing Accounts	
Require low-consumption toilets to be installed at the time of sale	*Water Provider's*– requirement at time of sale	Work with the real estate industry to require a certificate of compliance be submitted to the Water Provider that verifies that a plumber has inspected the property and efficient fixtures were either already there or were installed at the time of sale, before close of escrow. (Model after City of Los Angeles and San Diego.)
Rebates for 6/3 dual-flush or 4-liter toilets	*Water Provider's*– rebate	Provide a rebate or voucher for the retrofit of a 6/3 dual flush, 4-liter or equivalent very low water use toilet. Rebate amounts would reflect the incremental purchase cost and would be in the range of $50 to $100 per toilet replaced.
Rebates for high-efficiency clothes washers	*Water Provider's*– rebate	Together with local energy companies, if possible, offer rebates for purchase of water-efficient machines. Rebates would be scaled to water efficiency as rated by the Consortium for Energy Efficiency Inc.
Low-income home leak detection and repair	*Water Provider's*– promotes	Use leak detection equipment to determine whether and where leaks are occurring on the premises. The Water Provider would then provide a plumber to the customer to repair leaks for free to qualifying households (low income).
Distribute retrofit kits w/low-flow showerheads	*Water Provider's*– requirement	During an audit or through direct mail solicitation, a free retrofit kit would be provided to existing older single-family residential homes. The kit could contain a low-flow showerhead; toilet leak-detection dye tablets, displacement device, or early closure device; a faucet aerator, faucet washers to fix leaky faucets; and a pamphlet on how to conserve water.
Increase school education programs	*Water Provider's*– promotes	The Water Provider would provide school conservation programs with workbooks, presentations, and teaching materials and other educational tools to teach the students the importance of conserving water.
Incentives for out-door use reductions —new homes		Irrigation system upgrades, soaker hoses, mulch and soil amend-ments, new plant materials, landscape design, turf reduction, water allocation for landscapes
Require high-efficiency clothes washing machines	*City / County*– requirement	The Water Provider would educate its customers through bill collection brochures, displays at points of purchase, the media, on the latest clothes washer water conserving technology. Building departments would be responsible to ensure that an efficient washer was installed before new home occupancy.

Table continued next page.

Table 3-6 Example of potential conservation measures—*continued*

Device or Program	Measure: Distribution Method & Incentive	Measure: Description
Insulate hot water piping	*City / County*–requirement	Change building codes as necessary to require installation of hot water pipe insulation on new residences.
Rebates for 6/3 dual flush or 4-liter toilets	*Water Provider's*–rebate	Water Provider offers a coupon or rebate to replace an existing toilet with a 6/3 dual flush toilet.
Require 6/3 dual flush or 4-liter toilets in new homes	*City / County*–requirement	Building departments would be responsible to ensure that a 6/3 dual flush or 4-liter toilet was installed before new home occupancy.
Landscape water use improvements		Incentives and regulations

Technology/market maturity. This screening criterion indicates whether the necessary technology is available commercially and supported by the local service industry. For example, a device may be screened out if it is not yet commercially available in the region.

Service area match. This screening criterion seeks to distinguish the technology that is appropriate for the area's climate, building stock, or lifestyle. For example, low water-use landscape measures for commercial sites may not be appropriate where water use analysis indicates there is little outdoor irrigation.

Customer acceptance/equity. Customers must be willing to implement measures or else the market penetration rates (and thus the water savings) would be too low to be significant. Customer acceptance may be based on

- Convenience
- Economics
- Perceived fairness
- Aesthetics
- Environmental values

Measures should also be equitable in the sense that one category of customers should not benefit while another pays the costs without receiving benefits.

Better measure available. If a choice must be made between two or more measures of equal effectiveness for the same targeted end use, where one is obviously more appropriate (i.e., ease of implementation or unit cost), the more appropriate measure will pass the screening. Measures obviously not cost-effective can be screened out.

The criteria can be scored on a scale of 1 to 5, with 5 being the most acceptable. Measures with low scores can be eliminated from further consideration, while those with high scores pass into the next phase—water savings analysis.

Screening process. The measures can be rated in the table such as shown in Table 3-7 and Figure 3-5. As shown in the table, each measure has been scored on a

Table 3-7 Example of screening potential conservation measures and results of screening

Measure		Criteria				Pass
Device or Program	Distribution Method & Incentive	Technology Market Maturity	Service Area Match	Customer Acceptance/ Equity	Better Measure Available	Score Yes or No
Single Family Residential—Indoor						
Existing Accounts						
Require 1.6 gal/flush toilet to be installed at the time of sale	*Water Retailers'* requirement at time of sale	5	4	4	4	17 Yes
Rebates for 6/3 dual-flush or 4-liter toilets	*Water Retailers'* rebate	4	3	3	2	12 No
Rebates for high-efficiency clothes washers	*Water Retailers'* rebate	5	4	4	4	17 Yes
Low-income home leak detection and repair	*Water Retailers'* promote	2	3	3	2	10 No
Distribute retrofit kits w/low-flow showerheads	*Water Retailers'* requirement	5	4	4	4	17 Yes
Increase school education programs	*Water Retailers'* sponsor	5	4	3	4	16 Yes
New Homes						
Require high efficiency clothes washing machines	*Water Retailers'/ City/County* requirement	5	3	2	3	13 No
Insulate hot water piping	*Water Retailers'/ City/County* requirement	5	3	3	3	14 No
Rebates for 6/3 dual-flush or 4-liter toilets	*Water Retailers'* rebate	3	4	3	4	14 No
Require 6/3 dual-flush or 4-liter toilets for new homes	*Water Retailers'/ City/County* requirement	2	4	3	4	13 No

scale of 1 to 5, with 5 being a high rating. Generally measures were eliminated that scored mostly 1's and 2's with a few 5's. The screening is qualitative and subjective and can be done by a group that is likely to interpret and score measures differently. The goal was to reduce the list to about 20 to 30 measures that *pass* the screen, i.e., have relatively high scores. In general, a measure has to have 17 or more total ratings or points in order to pass this screen.

- Water Saver Home Web Site, www.h2ouse.org developed by the California Urban Water Conservation Council and funded by the US Environmental Protection Agency and US Bureau of Reclamation.
- Full program savings assessments and pilot test results that are published in AWWA Journals and Annual and AWWA Water Sources Conference Proceedings.
- Data from other nearby water utilities or the state agency tasked with overseeing urban water demand (e.g., California Department of Water Resources).
- Data from USGS Water Use Survey, (http:/water/usgs.gov/pubs/circ/2004/circ12681).
- *Evaluating Urban Water Conservation Programs: A Procedures Manual*, AWWA, 1993.

HOW TO DETERMINE THE BENEFITS OF EFFICIENCY MEASURES

Savings to the utility result from avoided costs (the benefits from implementing efficiency measures that achieve water savings). The following section describes the three principal ways that avoided costs accrue: (1) reduced water purchases (if the utility is a wholesale customer of another water purveyor); (2) lowered O&M expenses; and (3) delayed, downsized, or eliminated capital facilities.

Cost Savings From the Reduced Purchase of Water

A straightforward calculation results in the average annual unit cost of purchased water from a wholesaler using the following expression:

$$AWC = UPW \times UCPW \tag{4-6}$$

Where:

AWC	=	annual water cost
UPW	=	units purchased annually
$UCPW$	=	unit cost of purchased water

The planner can calculate the amount of cost savings by multiplying the unit cost of purchased water by the units of water savings estimated from efficiency measures. An added level of detail can be used if a higher cost is charged in peak-use period (e.g., high irrigation season). Then, the average cost during this period (typically a few months time) is divided by the units of purchased water over the same time span. This unit cost of peak-period purchased water is multiplied by the water savings from efficiency measures targeting water reductions during that period (commonly outdoor irrigation efficiency measures).

Cost Savings From Reduced Operation and Maintenance (O & M) Expenses

Because lowering demand results in less water produced, efficiency measures can reduce expenses dependent on amount of water produced or variable costs for utility operations, such as energy and chemical costs. In addition, some fixed costs may be associated with these variable costs of energy and chemical usage and may be

included, if warranted. Only the variable costs that are attributed to water efficiency activities are included in the calculation of avoided costs shown here.

To estimate the variable cost of energy ($/unit of water), use the following formula:

$$VUCE = [AEC - (12 \times MFEC) - (ECNP)] / UWU \quad (4\text{-}7)$$

Where:

- *VUCE* = variable unit cost of energy
- *AEC* = annual energy bill (cost)
- *MFEC* = monthly fixed charges for energy
- *ECNP* = energy costs not related to water production are those costs independent of actual water production, such as building heating, cooling, lighting, and process equipment use. These costs should be included unless the water production is lowered to the extent that facilities (e.g., certain buildings or pieces of equipment) are not used, which would rarely be the case.
- *UWU* = annual units of water used

Cost savings are calculated by multiplying the variable unit cost of energy by the units of water saved per year as a result of an efficiency measure.

In most cases, costs associated with chemicals are variable because the chemicals are added based on flow with very few fixed costs. To calculate the variable cost of chemicals ($/unit of water), use the following formula:

$$VUCC = [ACC - CCNP] / UWU \quad (4\text{-}8)$$

Where:

- *VUCC* = variable unit cost of chemicals
- *ACC* = annual chemical bill (cost)
- *CCNP* = chemical costs not related to productions (e.g., delivery charges unless reduced)
- *UWU* = annual units of water used

Cost savings are calculated by multiplying the unit cost of chemicals by the units of water saved per year as a result of a conservation measure. The benefits derived from wastewater operations for energy and chemical savings can be calculated in a similar manner.

Cost Savings From Delayed, Downsized, or Eliminated Capital Facilities

Water efficiency can affect both the requirements for current operations, expansion of existing facilities, and planned new facilities. Most capital facilities are designed to meet peak demands in some future year. Typical design horizons are 10 to 20 years. Although indoor conservation measures will reduce average day and peak day demands, savings in landscape, cooling water, and other summer uses will have greater effects on reducing the peak. In cities with hot or arid climates, peak to average day ratios of 2.0 to 3.0 are common. In humid or colder climates, peak day ratios of 1.2 to 1.7 are common. The peak-day ratio can be determined by comparing utility water production records using the following formula:

Peak-day ratio = highest day production / average day production (4-9)

The timing of capital facilities depends on the rate of growth in peak demand and the capacity of existing facilities. If the planned facilities are dependent on the growth of water demand, reduction in future water use can affect the timing of construction of these facilitates. Figure 4-2 illustrates an example of how water conservation could affect the timing of capital facilities. In this case, a water treatment facility needed in 2020 could be delayed about 7 years. In the example shown, demand reduction would reduce peak-day demands by about 20 percent. The resultant dollar savings to the utility are the difference in the present value of the costs associated with building the facility in 2027 instead of 2020.

A utility's efficiency program would reduce peak-day water use by 15 percent. Cost savings to the utility are the difference between building the plant at two different points in time (less debt service), plus the elimination of operating expenses for the years of delayed construction.

If demand is leveling off as growth slows down, reducing demand may reduce the need for the last expansion. In this case, the last expansion can be downsized. The capital cost savings associated with a smaller facility can be converted to present worth and added to other conservation benefits.

Information on the timing and sizing of capital facilities can often be found in the utility's capital facility plan, water supply plan, and/or water master plan. Unfortunately, sometimes the capital facilities are only identified a few years in advance, and projections of needed facilities must be made using demand projections and the design criteria.

To evaluate the impacts of efficiency, both peak-day and average-day water use must be considered. Peak-day water use usually occurs on or near the warmest day of the year for the community when outdoor irrigation has the highest demand of the season.

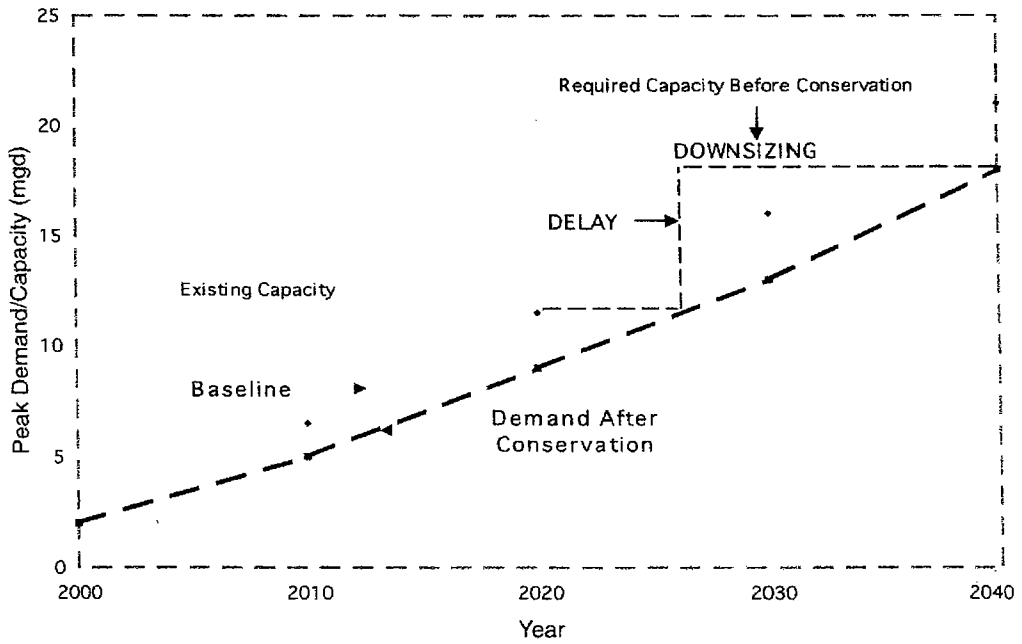

Figure 4-2 Example of delaying and/or downsizing a capital facility

Water System Design Criteria

New water facilities present an opportunity to downsize or postpone expansions. This can occur if the design of the facility is dependent on water flows. Table 4-1 shows typical design criteria for water facilities that may be affected by reduced consumption. Reduction in average day demand affects how much water must be developed, or imported and stored, prior to treatment and use. Reduction in peak day demand affects the sizing and timing of water treatment plant expansions and treated water storage. Water pipelines and pumping stations are affected by peak hour pumping. Peak hour is dependent on customer peak hour demands plus required fire flows. The latter is based on the type of land use to be protected.

Wastewater System Design Criteria

Table 4-2 shows the impacts of conservation (wastewater flow reduction) on design of new facilities. Design criteria for land disposal systems are volume dependent. Most facilities are based on peak wet weather flow, which can benefit from infiltration/inflow (I/I) control programs but are little affected by conservation programs, which save much less water than I/I contributes.

Table 4-1 Water system elements affected by conservation

	Design Criteria Based On			
System Element	Average Day	Peak Day	Peak Hour	Fire Flow
Source Water Acquisition	√			
Raw Water Storage	√			
Water Pipelines		√*	√	√
Water Treatment Plants		√		
Pumping Stations			√	√
Treated Water Storage		√		√

*Source and transmission pipelines

Source: W.O. Maddaus, *Estimating the Benefits for Water Conservation*, AWWA Conserv Conference Proceedings, 1999

Table 4-2 Wastewater system elements affected by conservation

	Design Criteria Based On		
System Elements	Average Dry Weather Flow	Peak Wet Weather Flow	Solids Loading
Collection Systems		√	
Interceptors		√	
Treatment Plants		√	√
Disposal to Receiving Water		√	
Land Disposal	√	√	

Source: W.O. Maddaus, *Estimating the Benefits for Water Conservation*, AWWA Conserv Conference Proceedings, 1999